

## Application Note

### **Edwards Aquifer Authority Uses Aqua TROLL® 200 Instruments to Aid Research Efforts**

*Unique system in south-central Texas serves millions and supports endangered species*

#### **Application**

Karst is a landscape or terrain formed by the dissolution of soluble rocks, such as limestone, marble, dolomite, gypsum, and halite. Karst regions contain aquifers capable of providing large supplies of water. Approximately 10 percent of the Earth's surface is occupied by karst landscape and more than 25 percent of the world's population depends on water supplied from karst areas. In the United States, 20 percent of the land surface is karst and 40 percent of the groundwater used for drinking comes from karst aquifers. Natural features of karst landscapes, including caves, springs, and endemic species, contribute to the aquifer's resource value. Living on top of karst landscapes can present challenges such as groundwater contamination, unpredictable water supply, ground subsidence, sinkhole collapse, and damage to subterranean ecosystems.

#### **Aquifer serves 1.7 million people and supports biodiversity**

Considered one of the most prolific artesian aquifers in the world, the San Antonio segment of the Balcones Fault Zone (Edwards Aquifer) is 180 miles (289 km) long with a width varying between 5 and 40 miles (8 and 64 km). Located in south-central Texas, the Edwards Aquifer is the main water for over 1.7 million people, including the City of San Antonio—the third largest metropolitan area in Texas and the only major city in the United States that obtains its entire water supply from a single aquifer.

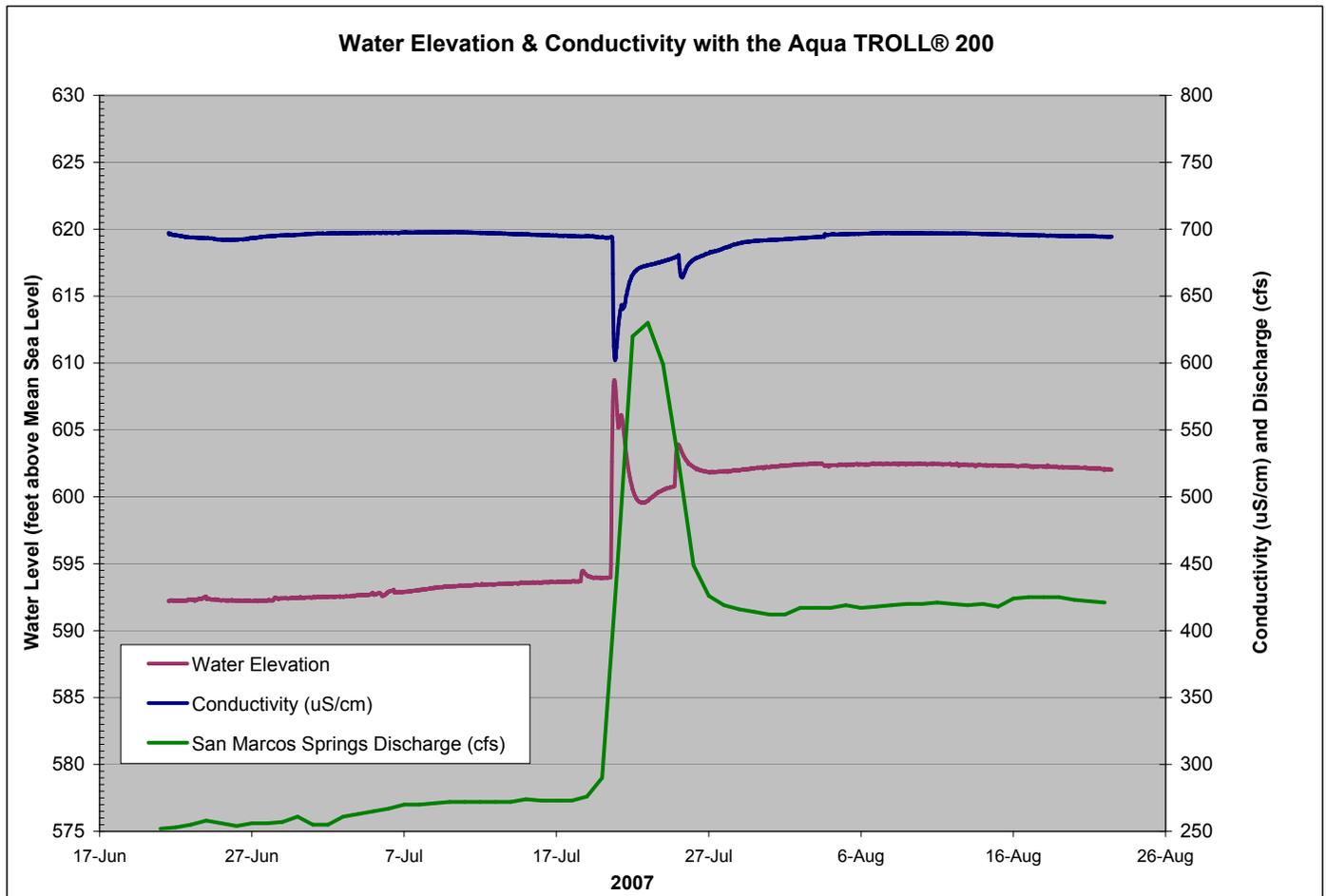
In 1977, the U.S. Environmental Protection Agency (USEPA) designated the Edwards Aquifer as the first sole-source aquifer, meaning the aquifer supplies at least 50 percent of the drinking water to persons living over the aquifer and that no other feasible alternative source of drinking water is available. The Edwards



*Groundwater discharges from the bottom of Spring Lake at San Marcos create sand boils. Photo courtesy of Charles Kreitler and Bridget Lewin, Diving for Science, Texas State University at San Marcos.*

Aquifer system is also the sole-source of water for more than 60 endemic species of animals and plants—several threatened or endangered.

The Edwards Aquifer is comprised of three distinct segments: the drainage area, the recharge zone, and the artesian zone. The artesian zone covers approximately 2,100 square miles (5,438 km<sup>2</sup>) and underlies all or a portion of the 10 counties south and east of the Balcones Fault Zone. The artesian zone is a complex, hydraulically connected network. In certain places, artesian pressure forces water to the surface through faults, forming springs. The Edwards Aquifer contains several spring ecosystems, such as Comal Springs, San Pedro Springs, and San Marcos Springs. San Marcos Springs, one of the largest spring complexes of the aquifer, is home to highly-adapted, aquatic, subterranean species such as blind salamanders and fountain darters.



After a rain event, San Marcos Springs discharge, measured by a U.S. Geological Survey gage downstream from the springs, correlates with increased level and decreased conductivity, both measured by an Aqua TROLL 200 Instrument at a well four miles up gradient from the springs. The sharp peaks reflect the high transmissivity of the groundwater flow paths of the karst aquifer.

### Karst dynamics create challenges

Unlike sand/gravel aquifers in which groundwater flow is laminar, the Edwards Aquifer and other karst (limestone) aquifers in Iowa, Missouri, Florida, and other regions exhibit rapid groundwater flow through high-transmissivity flow paths or conduits.

“This rapid response makes a close relationship between groundwater levels and spring flow,” says Steve Johnson, Hydrogeologist Supervisor with the Edwards Aquifer Authority (EAA). The EAA is the regional groundwater agency charged with managing, enhancing, and protecting the aquifer and its habitat.

Johnson and his associates collect and evaluate data that relate groundwater levels and conductivity with flow at San Marcos Springs. They aim to determine how aquifer dynamics affect the water, vegetation, and protective cover for endangered species.

During dry periods or drought, pumping from the aquifer increases and spring flows decrease, which

can significantly alter aquatic habitats (see the In-Situ application note: *Drought Notification System in Texas Monitors Groundwater Levels and Spring Flow to Trigger Action*). The potential for saltwater intrusion can occur if aquifer levels are drawn below historic lows.

Currently, scientists use Aqua TROLL 200 Instruments to log water level and conductivity measurements. This data is compared to aquifer discharge patterns and recharge events and is used to interpret groundwater flow and aquifer characteristics. This information provides the technical basis for policy decisions related to protecting and preserving the Edwards Aquifer.

Aqua TROLL® 200 Instruments, located in wells 3 to 5 miles (4.8 to 8 km) from the springs, continuously monitor conductivity, level, and temperature. Scientists then correlate those readings with similar measurements at the springs. They also conduct tracer tests to measure groundwater velocity, which can range from 0.5 mile to 1 mile (0.8 to 1.6 km) per day.



*The San Marcos salamander is a threatened species and lives primarily on limestone shelves in spring areas of Spring Lake but has been found several hundred feet downstream from Spring Lake Dam. Photo courtesy of Joe N. Fries, U.S. Fish and Wildlife Service.*

Each Aqua TROLL 200 deployed by the EAA is configured to run on an external solar rechargeable battery. Should the external power fail or be disconnected, the Aqua TROLL 200 automatically reverts to its internal, lithium ion battery, which has a typical 5-year life when logging data every 15 minutes.

### **Database targets effective and appropriate regulations**

Measurements from the Aqua TROLL 200 Instruments, along with tracer tests, are helping scientists acquire the data needed to determine how discharge and recharge are affecting the San Marcos Springs.

“We use data such as this to determine policies that will help manage the Edwards Aquifer effectively,” says Johnson. “Our goal is to protect and preserve the Edwards Aquifer as a water supply while maintaining the ecosystem.”

Visit [www.in-situ.com](http://www.in-situ.com) to learn how Aqua TROLL 200 instruments, designed for reliable operation and communication, can support monitoring and data collection programs.



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This application note does not constitute a product endorsement by the Edwards Aquifer Authority.

### **References**

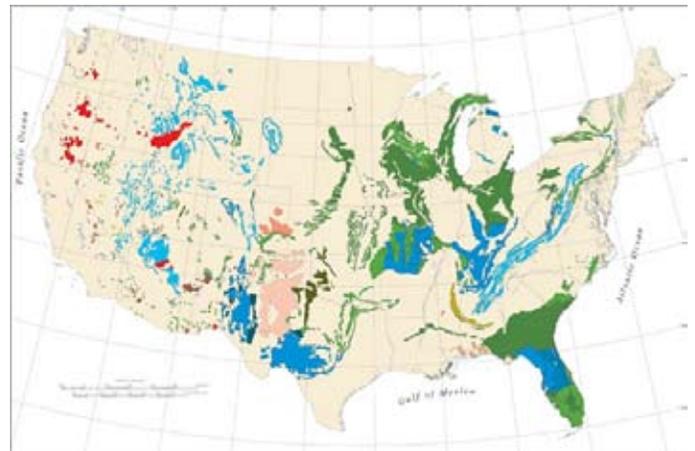
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U.S. Geological Survey National Karst Map

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